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CLAIMS

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[Claim(s)]

[Claim 1] The stator core which has many slots in the inner skin section. the shape of U character of a large number \*\*\*\*(ed) by many slots of the aforementioned stator core from one side -- a conductor -- having -- the above -- a conductor -- the conductor which a segment assembling-die stator coil makes neutral point connection of the one edge each of many phase coils, and constitutes a star type connection polyphase coil -- a segment assembling-die stator coil It has housing which has the peripheral wall which supports the aforementioned stator core in inner skin, and the end wall of the couple which is installed in the path inside from the ends of the aforementioned peripheral wall, and supports Rota free [ rotation ] through a bearing. the shape of each aforementioned U character -- a conductor -- mutual -- between the end faces of the bay of an parallel couple -- tying -- a \*\*\*\* side coil -- and -- \*\* -- with the music section to make It jumps out. the aforementioned bay which jumped out to the other side of the aforementioned slot to the aforementioned slot -- jumping out -- a portion -- a hoop direction -- curving -- jumping out -- a section side coil -- and -- \*\* -- while making -- the shape of U aforementioned character of others [ point ] -- it is joined to the point of a conductor a couple every -- with the section the aforementioned \*\*\*\* and the slot which jumps out, connects the section and is held in the aforementioned slot -- a conductor -- the section the conductor equipped with the above -- the drawer which makes the output outgoing line which is the rotation electrical machinery which has a segment assembling-die stator coil, and is installed from the end of each aforementioned phase coil -- a conductor and the neutral point which makes the aforementioned neutral point -- a conductor is characterized by also locating the aforementioned \*\*\*\* side coil and a twist in an anti-stator-core side further, and arranging them in the one side of the aforementioned slot

[Claim 2] the conductor according to claim 1 characterized by providing the following -- the rotation electrical machinery which has a segment assembling-die stator coil the aforementioned drawer -- a conductor is curved to a hoop direction in the other side of the aforementioned slot -- having -- the predetermined shape of U aforementioned character -- the beginning joined to the aforementioned joint of a conductor -- jumping out -- the section the first slot which makes the coil portion to which the aforementioned beginning jumps out, and an end extends from the section, and approaches the aforementioned output outgoing line most -- a conductor -- the section -- the conductor of the beginning of the aforementioned phase coil -- the conductor characterized by constituting a segment -- a segment assembling-die stator coil

[Claim 3] a conductor according to claim 2 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- the aforementioned drawer -- a conductor -- each above -- a conductor -- the conductor characterized by also locating further the aforementioned \*\*\*\* side coil and twist of a segment in an anti-stator-core side, and carrying out predetermined angle extension at a hoop direction -- the rotation electrical machinery which has a segment assembling-die stator coil

[Claim 4] the conductor according to claim 1 characterized by providing the following -- the rotation electrical machinery which has a segment assembling-die stator coil the aforementioned neutral point -- a conductor is curved to a hoop direction in the other side of the aforementioned slot -- having -- the predetermined shape of U aforementioned character -- the last joined to the aforementioned joint of a conductor -- jumping out -- the section the slot of the last which makes the coil portion to which the aforementioned last jumps out, and an end extends from the section, and approaches the aforementioned neutral point most -- a conductor -- the section -- the conductor of the last of the aforementioned phase coil -- the conductor characterized by constituting a segment -- a segment assembling-die stator coil

[Claim 5] a conductor according to claim 4 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- each aforementioned neutral point -- a conductor -- each above -- a conductor -- the conductor characterized by carrying out predetermined angle extension at a hoop direction, the aforementioned \*\*\*\* side coil and

twist of a segment also being further located in an anti-stator-core side, and lapping with shaft orientations mutually -- the rotation electrical machinery which has a segment assembling-die stator coil

[Claim 6] In the rotation electrical machinery which has a segment assembling-die stator coil a conductor according to claim 1 -- each aforementioned phase coil It has the partial phase coil of the couple around which a phase leaves only  $\pi$  by the electrical angle mutually, and a wave volume is looped by the aforementioned stator core. both the aforementioned partial phase coil A series connection is carried out through the connection section which was formed in one side of both the aforementioned partial phase coil or both, and one, and was installed in the hoop direction in the one side of the aforementioned slot. the aforementioned connection section each above -- a conductor -- the conductor characterized by arranging further the aforementioned \*\*\*\* side coil and twist of a segment at an anti-stator-core side -  
- the rotation electrical machinery which has a segment assembling-die stator coil

[Claim 7] the conductor according to claim 1 to 6 characterized by providing the following -- the rotation electrical machinery which has a segment assembling-die stator coil while it sticks to the inner skin of the aforementioned stator core and being installed by shaft orientations -- ends -- the internal surface of housing -- being close -- the aforementioned housing -- the above -- a conductor -- the cylinder-like seal which forms the stator hold space in which a segment assembling-die stator coil and the aforementioned stator core are held -- a member The run through-hole which opens the coil and hold space of a couple of the aforementioned stator core of the aforementioned stator hold space for free passage. [ of both sides ] Radiator. the aforementioned pump -- having -- the aforementioned pump -- both the aforementioned coils and hold space -- on the other hand -- a free passage -- the conductor characterized by circulating the coolant in order of another side of a hole, both the aforementioned coils, and hold space, and a radiator, and passing the aforementioned coolant to shaft orientations at least in the aforementioned coil and hold space -- a segment assembling-die stator coil

[Claim 8] a conductor according to claim 7 -- the conductor which boils, turns and carries out opening and which the piping section which connects the aforementioned coil and the hold space and the aforementioned radiator, or the pump which jumps out the account of before and holds a section side coil end in the rotation electrical machinery which have a segment assembling die stator coil jump out the account of before , be locate in the shaft orientations anti-stator core side of a section side coil end , jump out the account of before , and carry out [ a section side coil and \*\*\*\* or inhale the coolant from this

[Claim 9] the conductor according to claim 8 characterized by providing the following -- the rotation electrical machinery which has a segment assembling-die stator coil The approximate circle tubed layer insulation board which has electric insulation, and the path inside jumps out the account of before, and the section or the music section, and a path outside jump out the account of before, and is interposed between the section or the music section. The direction path of a path which is formed between the aforementioned layer insulation board and the end face of the aforementioned stator core, and passes the aforementioned coolant in the direction of a path at least.

[Claim 10] a conductor according to claim 1 -- the conductor characterized by the aforementioned ends wall of the aforementioned housing supporting the shank of inside Rota free [ rotation ] through the aforementioned cylinder-like shank and a bearing in the rotation electrical machinery which has a segment assembling-die stator coil while supporting the cylinder-like shank of outside Rota free [ rotation ] through a bearing -- the rotation electrical machinery which has a segment assembling-die stator coil

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention -- a conductor -- it is related with the rotation electrical machinery which has a segment assembling-die stator coil

[0002]

[Description of the Prior Art] the pine which inserted in the slot JP,11-75334,A which becomes application of these people -- foliaceous -- the conductor which joined one by one and formed the edges of a conductor (the shape of U character -- it is also called a conductor) by the end side of a stator core -- the rotation electrical machinery which has a segment assembling-die stator coil is indicated this conductor -- since the rotation electrical machinery which has a segment assembling-die stator coil does not need the so-called winding process -- the cross section of a stator coil -- the occupancy space cross section of a slot -- abbreviation -- it can consider as an equal rectangle cross section (similarity), and by improvement in a slot space factor, it is small and the rotation electrical machinery of high power can be realized

[0003] moreover, JP,11-75346,A -- this conductor -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- a conductor -- the open-sand-mold rotation electrical machinery which \*\*\*\*(ed) the coil and portion of a segment to the forward direction at the flow direction of the cooling style and the Rota hand of cut, and improved the coil and the air-cooling effect is indicated

[0004]

[Problem(s) to be Solved by the Invention] however, the above-mentioned conductor -- with the rotation electrical machinery which has a segment assembling-die stator coil, since a stator coil was produced by completely different technique from the conventional coil winding process, the coil of the both sides of a stator coil and the shaft-orientations required size of a portion became uneven, and, for this reason, it had the problem that the shaft-orientations length of the space between the end wall of the both sides of housing and the end face of a stator core (henceforth a coil and hold space) became imbalanced

[0005] Furthermore, it explains.

[0006] a conductor -- the rotation electrical machinery which has a segment assembling-die stator coil -- one coil end -- the shape of U character -- since it consists of the music sections which connect the bay of the couple of a conductor -- a conductor -- since junction between segments is not needed and curve formation can be beforehand carried out before slot insertion at the shape of U character, the shaft-orientations length of this \*\*\*\* side coil end can be taken as necessary minimum

[0007] On the other hand, since the coil end of another side is a slot and parallel for slot insertion at the time of slot insertion, it jumps out of a slot and it is bent and produced by the hoop direction the back the bottom, When it bends too much, an insulating coat may be torn, or stress may remain, insulation deterioration may be carried out, it will be difficult to bend to an acute angle to a hoop direction, it will jump out as the result, and the shaft-orientations length of a section side coil end will become large to it of a \*\*\*\* side coil end.

[0008] moreover -- jumping out -- a section side coil end -- from a slot -- jumping out -- the bottom -- a conductor -- it is the bay of a segment -- although it jumps out, the section is bent and it is produced -- this -- it jumped out, and others needed to jump out, the point of the section needed to be joined to the point of the section, and, for this reason, it was crooked to the hoop direction -- it jumps out, and the point of the section needs to be installed again to shaft orientations, Therefore, it will jump out and the shaft-orientations length of a section side coil end will become still larger.

[0009] Since it is supported by the end wall of the both sides of housing through a bearing, Rota is the space between these end walls and the end face of a stator core (the above-mentioned imbalance of the shaft-orientations length of a

coil and hold space worsens the Rota support nature hereafter.).

[0010] Furthermore, it explains.

[0011] Usually, it is difficult to make the rotation center of gravity of Rota completely in agreement with an axial center, predetermined distance eccentricity of the Rota center of gravity is carried out from the axial center, for this reason, the centrifugal force rotated at this Rota center of gravity by rotation of Rota acts, and the force of the direction of a path is applied to the shaft which supports Rota and it. Although this force is finally supported by the end-wall section of housing through a shaft and a bearing, if the distance from the Rota center of gravity to the end-wall section of housing is large, by the bending moment proportional to this distance, it turns at a shaft in the direction of a path, and it originates in this, vibration of Rota will arise or a bad influence will produce it in a bearing. although what distance from the Rota center of gravity to the end-wall section of the both sides of housing is made small for, respectively (suppose that it is equal) is required in order to improve this problem -- a conductor -- with the rotation electrical machinery which has a segment assembling-die stator coil, the equation of this distance is not easy by the reason for the above

[0012] Of course, although a cure, such as making a shaft thick, is possible, it causes increase of a weight and volume. Moreover, with the double Rota type rotation electrical machinery which it comes to cover the path outside in inside Rota free [ relative rotation of outside Rota ], since the shaft of outside Rota becomes cylindrical shape-like, considering the need for \*\*\*\*-izing of the diameter of a bearing, it is not easy to fully increase the cross section of a shaft.

[0013] the conductor above-mentioned to this double Rota type rotation electrical machinery and high-speed rotation electrical machinery after all -- using a segment assembling-die stator coil had the problem that it was not realistic in respect of the Rota vibration

[0014] this invention is made in view of the above-mentioned trouble -- having -- a conductor -- it sets it as the purpose to reduce the Rota vibration of double Rota type rotation electrical machinery or high-speed rotation electrical machinery irrespective of the unique configuration of the coil end of a segment assembling-die stator coil, avoiding weight increase

[0015] next, the conductor mentioned above -- the calorific value [ in / the part and these space / with the rotation electrical machinery which has a segment assembling-die stator coil, the occupancy density of the conductor in the space, the coil, and existence space within a slot is high, and ] per unit capacity -- increasing -- as these results -- a conductor -- there was a problem that a segment etc. elevated-temperature-ized although improving the cooling nature of a stator coil by adoption of the technology (it is called a coil and liquid cooling technology) which carries out liquid cooling of the coil end of a well-known stator coil is also considered -- a conductor -- in the segment assembling-die stator coil, since a conductor is accumulated with high density in a coil and a portion as mentioned above, the flow of the coolant got worse and the improvement effect which is the cooling nature of the stator coil by liquid cooling technical adoption has been reduced Of course, although this problem is improvable by reinforcing the horsepower of a cooling-fluid-flow pump, the whole rotation electrical machinery efficiency will fall.

[0016] moreover -- although the coil and liquid cooling technology which were mentioned above do so the outstanding suitor coil cooling nature -- a conductor -- the rotation electrical machinery which has a segment assembling-die stator coil -- the conductor of both coil ends -- since it became unequal as an amount and its total surface area mentioned above, there was also a problem that the cooling nature of both coil ends varied

[0017] this invention is made in view of the above-mentioned trouble -- having -- a conductor -- it sets it as the purpose to improve the cooling nature of a stator coil irrespective of the unique configuration of the coil end of a segment assembling-die stator coil, without increasing pump power

[0018]

[Means for Solving the Problem] according to rotation electrical machinery according to claim 1 -- a conductor -- the neutral point which makes the neutral point of the stator coil of the star-type-connected polyphase which consists of segment assembling-die stator coils -- a conductor -- The output outgoing line of each phase coil is made and pulled out. and a conductor Since it jumps out, and a section side coil and a twist are also further located in an anti-stator-core side and a \*\*\*\* side coil and a twist are also arranged in a \*\*\*\* side coil end side with short shaft-orientations length these neutral points -- a conductor and a drawer -- it can compare with jumping out and preparing a conductor in a section side coil end side, dispersion in the shaft-orientations length of a \*\*\*\* coil end can be reduced and equated markedly, the technical problem which this mentioned above can be solved, and the following operation effects can be done so

[0019] That is, since the coil of both sides and the difference of the shaft-orientations required size of a portion can be reduced, the shaft-orientations length of the space between the end wall of the both sides of housing and the end face of a stator core (henceforth a coil and hold space) can be equated, and, thereby, it can prevent that the distance between

the Rota center of gravity and the bearing of the both sides increases. Consequently, the Rota vibration can be reduced without being able to decrease the shaft bending moment which acts on the Rota center of gravity, and attaining shaft large cross-section-ization with the eccentricity of the Rota center of gravity, a bearing can also be miniaturized, and rotation electrical machinery can be lightweight-ized.

[0020] according to composition according to claim 2 -- a conductor according to claim 1 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- further -- a drawer -- a conductor -- an one straight-line-like conductor -- a segment (the shape of I character -- it is also called a conductor) -- a slot -- inserting in -- the -- jumping out -- a section side -- usual -- jumping out -- the section -- the same -- a hoop direction -- bending -- jumping out -- a section side coil -- and -- \*\* -- it carries out

[0021] thus -- if it carries out -- the shape of other U character -- without it is interfered by the array of a conductor -- a \*\*\*\* side -- an output outgoing line -- it can arrange -- further -- jumping out -- a section side -- all -- it can jump out and can join good, the point, i.e., the joint, of the section

[0022] according to composition according to claim 3 -- a conductor according to claim 2 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- further -- a drawer -- since a pars-convoluta-lobuli-corticalis-renis side coil and a twist are also further located in an anti-stator-core side and carry out predetermined angle extension at a hoop direction, a conductor can arrange two or more output outgoing lines in the hoop-direction optimal position

[0023] according to composition according to claim 4 -- a conductor according to claim 1 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- further -- the neutral point -- a conductor -- an one straight-line-like conductor -- a segment (the shape of I character -- it is also called a conductor) -- a slot -- inserting in -- the -- jumping out -- a section side -- usual -- jumping out -- the section -- the same -- a hoop direction -- bending -- jumping out -- a section side coil -- and -- \*\* -- it carries out

[0024] thus -- if it carries out -- the shape of other U character -- without it is interfered by the array of a conductor -- a \*\*\*\* side -- the neutral point -- it can arrange -- further -- jumping out -- a section side -- all -- it can jump out and can join good, the point, i.e., the joint, of the section

[0025] according to composition according to claim 5 -- a conductor according to claim 4 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- further -- each neutral point -- since a conductor carries out predetermined angle extension at a hoop direction, a \*\*\*\* side coil and a twist also being further located in an anti-stator-core side, and lapping with shaft orientations -- each neutral point -- the required shaft-orientations length of the stator coil by the side of \*\*\*\* can be shortened, securing connection of a conductor good

[0026] according to composition according to claim 6 -- a conductor according to claim 1 -- in the rotation electrical machinery which has a segment assembling-die stator coil, further, a phase leaves only pi by the electrical angle mutually, and each phase coil has the partial phase coil of the couple by which the series connection was looped around and carried out to the stator core by the wave volume

[0027] Furthermore, as for connection of both [ these ] the partial phase coil, a \*\*\*\* side coil and a twist are also further performed in an anti-stator-core side.

[0028] Thereby, connection of both the partial phase coil jumps out, there is no bird clapper in the obstacle of connection of the joint of the section, and it jumps out and the advantage that the required shaft-orientations length of the stator coil by the side of the section (jumping out a section side coil and a group) does not increase arises.

[0029] in addition, connection of both this partial phase coil -- both the partial phase coil -- the neutral point -- a conductor and a drawer -- the shape of I character like a conductor -- what is necessary is to consider as a conductor, and to jump out, to install the one side or both as required for a hoop direction at the anti-stator-core side of a section side coil end, and just to perform them

[0030] according to composition according to claim 7 -- a conductor according to claim 1 to 6 -- in the rotation electrical machinery which has a segment assembling-die stator coil, further, the stator which consists of a stator coil and a stator core is sealed by housing and the cylinder-like seal member, and the coolant circulates through it between this stator hold space and an external radiator

[0031] With this composition, since it considers as the structure of passing the coolant to shaft orientations in the coil and hold space of stator-core both sides among this stator hold space, further, stator cooling efficiency can be improved, without increasing pump power.

[0032] Furthermore, it explains.

[0033] the conductor mentioned above -- both the coils of a segment assembling-die stator coil -- and -- coming out -- each \*\*\*\* and each \*\*\*\*\* separate a small gap mutually to shaft orientations and a hoop direction, and extend with high density in them Therefore, if the principal direction of a coolant style is made into the direction of a path in both [ these ] the coil end, fluid loss is large, the rate of flow will fall, and the fall of the rate of flow will cause decline in

the heat transfer efficiency between a coil end and the coolant.

[0034] Then, with this composition, a coolant style is passed to shaft orientations mainly along with a coil end. thus, the pars-convoluta-lobuli-corticalis-renis side coil with which it is rare with which to check a coil and the flow of a coolant style boiled and depended, and it adjoins if it carries out and between -- and it adjoins -- jumping out -- a section side coil and the above-mentioned smallness gap of a between -- a coil -- and it is alike, and it can meet, a high-speed coolant style can be formed, and a coil end can be cooled good under small pump power

[0035] furthermore, with this composition, it jumped out and the \*\*\*\* side coil and the group mentioned above as compared with the section side coil and the group -- pulling out -- a conductor and the neutral point -- since it has a conductor and the difference of both coils and the total surface area of a group is reducible, both coils and the heat release of a group can be equated

[0036] according to composition according to claim 8 -- a conductor according to claim 7 -- in the rotation electrical machinery which has a segment assembling-die stator coil, the coolant cooled externally \*\*\*\* or inhales the coolant further from opening which jumped out and was formed towards the shaft-orientations anti-stator-core side of a section side coil end

[0037] If it does in this way, the coolant can jump out avoiding consumption of speed energy, and can flow along the front face of a section side coil end.

[0038] according to composition according to claim 9 -- a conductor according to claim 8 -- in the rotation electrical machinery which has a segment assembling-die stator coil, the path inside jumps out, the section or the music section, and a path outside jump out, and a further approximate circle tubed layer insulation board is interposed between the section or the music section

[0039] If it does in this way, while the path inside jumps out, and the section or the music section, and a path outside jump out and being able to improve the electric insulation between the section or the music section, the coolant style in a coil and a group can be smoothly passed to shaft orientations. However, with this composition, even if the path inside jumps out and it turns to a section side coil end, the coolant is breathed out, while jumping out, and a path outside's jumping out in the shaft-orientations anti-stator-core side of a section side coil end and being breathed out towards a section side coil end.

[0040] Furthermore, with this composition, a gap, i.e., the direction path of a path, is formed between a layer insulation board and the end face of a stator core. Since the coolant style which reached the stator-core end face along with the coil end of the path inside is distributed to the both sides of a layer insulation board through this direction path of a path, it does not have a bird clapper as the coolant flow rate of the both sides of a layer insulation board is imbalanced.

[0041] according to composition according to claim 10 -- a conductor according to claim 1 -- the rotation electrical machinery which has a segment assembling-die stator coil -- setting -- further -- this conductor -- the stator which has a segment assembling-die stator coil is used for double Rota type rotation electrical machinery

[0042] If it does in this way, as mentioned already, vibration of outside Rota which has a cylinder-like shaft by equating the distance between the ends wall of housing and a rotor core end face can be reduced, and the bearing can be miniaturized.

[0043]

[Embodiments of the Invention] the conductor of this invention -- the suitable mode of the rotation electrical machinery which has a segment assembling-die stator coil is concretely explained with reference to the following examples

[0044]

[Example] With reference to the block diagram showing one example of the vehicles driving gear for hybrid cars using the rotation electrical machinery of this invention in drawing 1, it explains below.

(Whole structure) This equipment has an engine 100, the TORUKU rotational frequency converter 1000, the first inverter 2000, the second inverter 3000, and the battery 4000.

[0045] The TORUKU rotational frequency converter 1000 is the rotation electrical machinery of coaxial double Rota structure, and has 1st Rota (inside Rota) 1200 which is the axis of rotation 1100 and the 1st rotator, 2nd Rota 1300 (outside Rota) which is the 2nd rotator, and the stator 1400.

[0046] 1st Rota 1200 comes to loop around the three phase coil 1201 near the peripheral face of the core of the shape of a cylinder which fixed to the axis of rotation 1100, and the first inverter 2000 and power transfer are possible for the three phase coil 1201 through the set 1500 of the slip ring and a brush.

[0047] 2nd Rota 1300 is permanent field Rota, it is attached in 1st Rota 1200 free [ relative rotation ], and a predetermined interval is separated hoop-direction polarity alternation and respectively mutually, the magnetic pole, i.e., the permanent magnetic pole, which consists of a permanent magnet, and it is laid under the inner skin [ of 2nd Rota 1300 ], and peripheral face side. The peripheral face of 1st Rota 1200 separates a small gap to the inner skin of

2nd Rota 1300, and meets it, and the electromagnetic coupling of power generation and the torque generating of the three phase coil 1201 of 1st Rota 1200 is made possible to the permanent magnetic pole train by the side of the inner skin of 2nd Rota 1300.

[0048] A stator 1400 is a stator, it has the core 1410 of the shape of a cylinder which fixed in housing 1600, and the three phase stator coil 1420 looped around near the inner skin of this core 1410, and the second inverter 3000 and power transfer are possible for the three phase stator coil 1410.

[0049] The first inverter 2000 changed the ac power delivered and received with 1st Rota 1200 into the battery 4000 and the direct current power which deliver and receive, and the second inverter 3000 has changed a stator 1400 and the ac power which are delivered and received into the battery 4000 and the direct current power which are delivered and received.

[0050] The axis of rotation 1100 is directly linked with the crankshaft of an engine 100, and 2nd Rota 1300 has geared with the gear equipment 1901 for a wheel drive through a gear train 1900. 1902 is a tire.

[0051] Housing 1600 is supporting 1st Rota 1200 and 2nd Rota 1300 stator 1400 free [ rotation ] through the bearing which is not illustrated while \*\*\*\*(ing) and supporting a stator 1400, as mentioned above.

[0052] Since the rotation electrical machinery of the coaxial double Rota structure of the above-mentioned composition itself is well-known, the explanation beyond this is omitted.

(Operation of equipment) Inverters 2000 and 3000 are controlled by the controller which is not illustrated.

[0053] This controller receives the rotation position of 2nd Rota 1300 from the angle-of-rotation sensor 1800, and determines the phase of the three-phase-alternating-current voltage impressed to the three phase stator coil 1420 based on it. Moreover, the rotation position of the axis of rotation 1100 is received from the angle-of-rotation sensor 1700, and the phase of the three-phase-alternating-current voltage impressed to the three phase coil 1201 based on the rotation position of both Rota is determined. Moreover, PWM feedback control of the mean amplitude of the three-phase-alternating-current voltage impressed to the three phase stator coil 1201 based on the difference of the engine speed and target rotational frequency which were received from the angle-of-rotation sensor 1700 is carried out, and this is operating the engine at the target rotational frequency. Furthermore, torque equal to the difference of the torque and vehicles driving torque desired value which the first rotation electrical machinery MG 1 gives to 2nd Rota 1300 is generated by carrying out PWM control of the mean amplitude of the three-phase-alternating-current voltage impressed to the three phase stator coil 1420.

(Stator liquid cooling structure) The liquid cooling structure of a stator 1400 of making the feature portion of this following example is explained below with reference to drawing 2.

[0054] In 1610, a cylinder-like seal member and 1620 jump out, in a run through-hole and 1630, stator hold space and 1640 jump out, and, for a section side coil and hold space, and 1650, as for a layer insulation board and 1680, a \*\*\*\* side coil and hold space, and 1660 and 1670 are [ a delivery and 1690 ] inhalation mouths.

[0055] a cylinder-like seal -- while a member 1610 is stuck to the inner skin of a stator core 1410 and being installed by shaft orientations, ends form in the front face of the ends walls 1601 and 1602 of housing 1600 close and the stator hold space 1630 in which it is fixed to and a stator core 1410 and a stator coil 1420 are held with housing 1600 a cylinder-like seal -- although the member 1610 is formed with resin material, such as a polyimide, by this example, it may adopt non-magnetic metal material, such as aluminum

[0056] The run through-hole 1620 is cut in the peripheral wall 1603 of housing 1600 by shaft orientations along with the peripheral face of a stator core 1410, jumps out, and is opening a section side coil, the hold space 1640 and a \*\*\*\* side coil, and the hold space 1650 for free passage.

[0057] In this example, a stator coil 1420 It has a conductor 1422. the path outside arranged in the path outside (back side) of Slot S -- the path inside arranged a conductor 1421 and inside [ path ] Slot S (opening side) -- these path outside -- a conductor 1421 and the path inside -- the conductor 1422 is intercepted with the cylinder-like layer insulation boards 1660 and 1670 in the coil and group of both sides which jump out so that it may mention later, and are called a section side coil, Group A, a \*\*\*\* side coil, and Group B

[0058] A stator coil 1420 jumps out in the end-wall section 1601 of housing 1600, opening of the delivery 1680 is carried out to it towards a section side coil and Group A, and opening of the inhalation mouth 1690 is carried out to the end-wall section 1602 of housing 1600 towards the \*\*\*\* side coil and Group B of a stator coil 1420.

[0059] A delivery 1680 jumps out and breathes out the coolant breathed out from the pump 1680 towards a section side coil and Group A, and this breathed-out coolant flows in a \*\*\*\* side coil and the hold space 1650 via the run through-hole 1620, after flowing mainly to shaft orientations along with each \*\*\*\*\* side coil which jumps out, jumps out the inside of a section side coil and the hold space 1640, and constitutes a section side coil and Group A, and 1423.

[0060] in addition, the path inside -- a part of coolant which the conductor 1422 jumped out and flowed the path inside of the layer insulation board 1660 along with a section side coil and 1423 -- the opening side space S1 of Slot S --



leading -- a \*\*\*\* side coil and the hold space 1650 -- flowing -- the remainder -- the gap g1 between the layer insulation board 1660 and the end face of a stator core 1410 (the direction path of a path) -- leading -- a free passage -- it flows into a hole 1620

[0061] a free passage -- the path outside where a part of coolant which flowed into a \*\*\*\* side coil and the hold space 1650 from the hole 1620 is located in a path outside rather than the layer insulation board 1670 -- after flowing mainly to shaft-orientations length along with the \*\*\*\* side coil of a conductor 1421, and 1424, it is discharged by the inhalation mouth 1690 shell exterior, and is sent to a radiator 2200

[0062] The remainder of the coolant which flowed into a \*\*\*\* side coil and the hold space 1650 from the run through-hole 1620 Through the gap g2 between the layer insulation board 1670 and the end face of a stator core 1410 (the direction path of a path) with the coolant which flows into the path inside and flows through the opening side space S1 of Slot S rather than the layer insulation board 1670 the path inside located in the path inside rather than the layer insulation board 1670 -- after flowing mainly to shaft-orientations length along with the \*\*\*\* side coil of a conductor 1422, and 1424, it is discharged by the inhalation mouth 1690 shell exterior, and is sent to a radiator 2200

[0063] In drawing 1 , 2300 and 2400 are the piping sections which combine a radiator 2200, a pump 2100, and housing 1600.

[0064] after all -- the conductor of the rotation electrical machinery of this coaxial double Rota structure -- liquid cooling of the three phase stator coil 1420 which consists of a segment assembling-die stator coil is carried out, 1st Rota 1200 and 2nd Rota 1300 constitute the first rotation electrical machinery MG 1, and 2nd Rota 1300 and the stator 1400 constitute the second rotation electrical machinery MG 2

(Stator coil 1420) Next, the detailed structure of a stator coil 1420 is explained below with reference to drawing 1 - drawing 9 .

[0065] this stator coil 1420 -- a star three phase coil -- it is -- a conductor -- the shape of U character of a large number which make a segment -- the shape of I character of a conductor 1433 or the predetermined number mentioned later -- it is produced by carrying out the points of a conductor one by one by the end side (jumping out section side) of a stator core 1410, and joining

[0066] the shape of U characters each -- a conductor 1433 consists of rectangular copper wire covered with the insulating coat, as shown in drawing 3 , and it is inserted in Slot S at the bilayer 1434 is an insulator. furthermore -- if it explains -- the shape of U character -- music section 1433c of the piece to which a conductor 1433 makes a \*\*\*\* side coil end as shown in drawing 4 -- the slot of the couple individually held in the slot S of a couple which abbreviation electrical-angle pi separated mutually -- a conductor -- section 1433r -- a slot -- a conductor -- it extends from the edge of section 1433r, and the couple which jumps out and makes a section side coil end jumps out, and it has 1433s of sections, and it jumps out and 1433d of points of 1433s of sections constitutes the joint

[0067] The center of pars-convoluta-lobuli-corticalis-renis 1433c is peak 1433p most located in an anti-stator-core side, and pars-convoluta-lobuli-corticalis-renis 1433c is installed in hoop-direction both sides by electrical angle  $0.5\pi$  [ every ] shaft orientations and the hoop direction from peak 1433p. Similarly, it jumped out and, as for no less than 1433s of sections, only electrical angle  $0.5\pi$  has bent to the hoop direction.

[0068] The conductor 1433 is crooked in the direction of a path by peak 1433p of pars-convoluta-lobuli-corticalis-renis 1433c. the shape of furthermore, U character -- thereby it is connected with half one of pars-convoluta-lobuli-corticalis-renis 1433c at it -- on the other hand, a slot -- a conductor -- with section 1433r the one shape of U character which jumps out and consists of 1433s of the sections connected with it -- half one of a conductor 1433 (namely, a path outside conductor 1421) the slot of another side connected with other halves one and them of pars-convoluta-lobuli-corticalis-renis 1433c -- a conductor -- with section 1433r the one shape of U character which jumps out and consists of 1433s of the sections connected with it -- other halves one of a conductor 1433 (namely, the path inside conductor 1422) -- receiving -- the shape of about U characters -- only the \*\*\*\* direction length of a conductor 1433 is displacing in the direction of a path

[0069] the shape of U characters each -- a conductor 1433 is \*\*\*\*(ed) from one side in the slot S of the couple of a stator core 1411 -- having -- the other side of Slot S -- projection -- the bottom -- the shape of U character -- after the couple of a conductor 1433 jumping out and bending 1433s of sections to a hoop direction, it is considering as the three phase stator coil 1420 of the star of a wave volume by welding 1433d (joint) of points of 1433s of each \*\*\*\*\* a couple every in addition, when it explains still more finely, it is shown in drawing 5 -- as -- the path outside of a slot -- a conductor 1421 -- jumping out -- 1433d of points of 1433s of sections, and the path inside of a slot -- a conductor 1422 jumps out and 1433d of points of 1433s of sections is welded In addition, by drawing 4 , it jumps out, and the hoop-direction bending before is shown by the solid line, 1433s of sections is bent with a two-dot chain line, and the back is shown. drawing 4 -- the shape of U characters each -- it turns out that music section 1433c of a conductor 1433 is arranged at the one side of a stator core 1410, it jumps out and 1433s of sections is arranged at the other side

[0070] The partial perspective diagram of the stator coil 1420 after the completion of welding of 1433d of each joint is shown in drawing 5, and the development is shown in drawing 6. 1434 is an insulator. However, illustration of the layer insulation boards 1660 and 1670 is omitted.

[0071] An important thing has the shaft-orientations length of music section 1433c in the point containing 1433d of joints which jumps out and is smaller than the shaft-orientations length of 1433s of sections in this example. Since bending of music section 1433c of this is processing before insertion into Slot S, Since it jumps out, and 1433s of sections is bent to the ability to consider as a large angle, without [ therefore ] giving stress to an insulating coat or producing a tear after inserting in Slot S, if bending operation is easy to be restricted and bending is enlarged -- jumping out -- 1433s of sections, and a slot -- a conductor -- since the boundary section with section 1433r is worn by the corner of the stator core 1410 of the opening edge of Slot S and a blemish becomes easy to be attached to an insulating coat, it is because a bending angle cannot be enlarged. Moreover, it is necessary to make shaft orientations project 1433d of joints at the nose of cam of 1433s of sections on account of welding, and it will jump out, and for this reason, it will jump out and the shaft-orientations length of 1433s of sections will become still larger rather than music section 1433c.

[0072] For this reason, the conductor (the neutral point as used in the field of this invention conductor) which makes the neutral point of the stator coil 1420 which is a star three phase coil in this example, By arranging further in the anti-stator-core 1410 side the conductor (the drawer as used in the field of this invention conductor) which makes the output outgoing line of each phase coil rather than music section 1433c a \*\*\*\* side coil and 1424, and the neutral point -- a conductor and a drawer -- it jumps out with the \*\*\*\* side coil and B which are a set of a conductor, and they are a section side coil and a set of 1423 -- it jumps out and is made to reduce the difference of a section side coil and the shaft-orientations length between Groups A

[0073] The wiring development of U phase coil at the time of using this stator coil 1420 as a three phase circuit, six poles, and 18 slots is shown in drawing 7.

[0074] This U phase coil comes to carry out the series connection of the wave volume coil (partial phase coil as used in the field of this invention) 1433Y illustrated with a dashed line to wave-winding coil (partial phase coil as used in the field of this invention) 1433X illustrated as a solid line. Wave-winding coil 1433X and wave-winding coil 1433Y electrical-angle pi Shift, and the phase is arranged.

[0075] the end section of wave volume coil 1433X -- the shape of I character -- it considers as the conductor 1436

[0076] the shape of I character -- a conductor 1436 -- one -- jumping out -- the section for 1436s, and one slot -- a conductor -- the drawer as used in the field of section 1436r, one half-\*\*\*\* 1436c, and this invention -- the drawer which makes a conductor (output outgoing line) -- a conductor -- it consists of section 1436z the shape of I character -- a conductor 1436 -- an one straight-line-like conductor -- a segment -- the slot S of the beginning of wave volume coil 1433X -- inserting in -- the -- jumping out -- 1436s of sections -- bending -- jumping out -- 1436d of points of 1436s of sections -- the shape of U character of the beginning of wave volume coil 1433X -- it comes to weld to 1433d of points of a conductor 1433 As for half-music section 1436c, only the pitch of the half of the usual music section 1433c is bent by the hoop direction. a drawer -- a conductor -- after only a required angle extends from the end of half-\*\*\*\* 1436c to a hoop direction and it is installed in a path outside after that, section 1436z separating a predetermined gap to music section 1433c in the anti-stator-core 1410 side rather than music section 1433c, it is connected to the connector which was further fixed to the peripheral wall section 1603 of housing 1600 and which is not illustrated the output outgoing line as used in the field of [ with this composition ] this invention, i.e., a drawer, -- the drawer as a conductor -- a conductor -- shaft orientations can be approached and section 1436z can be prepared in music section 1433c of a \*\*\*\* side coil and Group B

[0077] the other end of wave volume coil 1433X -- the shape of I character -- it considers as the conductor 1437

[0078] the shape of I character -- a conductor 1437 -- one -- jumping out -- the section for 1437s, and one slot -- a conductor -- section 1437r, one half-\*\*\*\* 1437c, and connection -- a conductor -- it consists of section 1437z the shape of I character -- a conductor 1437 -- an one straight-line-like conductor -- a segment -- the slot S of the last of wave volume coil 1433X -- inserting in -- the -- jumping out -- 1437s of sections -- bending -- jumping out -- the shape of U character of the last of wave volume coil 1433X 1437d of points of 1437s of sections -- it comes to weld to 1433d of points of a conductor 1433

[0079] the shape of I character -- as for half-\*\*\*\* 1437c of a conductor 1437, only the pitch of the half of the usual music section 1433c has extended in the hoop direction connection -- a conductor -- the shape of I character by which only the required angle is installed in the hoop direction by section 1437z, separating a predetermined gap for the anti-stator-core 1410 side of music section 1433 from nose of cam of half-\*\*\*\* 1437c c between music section 1433c, and the point 1437y is inserted in the slot S of the beginning of wave volume coil 1433Y -- it is joined to nose-of-cam 1439y of half-\*\*\*\* 1439c of a conductor 1439 this shape of in addition, I character -- the composition of a conductor

1439 -- connection -- a conductor -- section 1437z -- removing -- the shape of I character -- since it is the same as a conductor 1437, explanation is omitted 1439d -- the shape of I character -- a conductor 1439 -- jumping out -- the point (joint) of 1439s of sections -- it is -- the shape of U character of the beginning of wave volume coil 1433Y -- a conductor 1433 jumps out and it is welded to 1433d of points of 1433s of sections

[0080] the other end of wave volume coil 1433Y -- the shape of I character -- it considers as the conductor 1438

[0081] the shape of this I character -- a conductor 1438 -- one -- jumping out -- the section for 1438s, and one slot -- a conductor -- section 1438r, one half-pars-convoluta-lobuli-corticalis-renis 1438c, and the neutral point -- a conductor -- it consists of section 1438z the shape of this I character -- a conductor 1438 -- an one straight-line-like conductor -- a segment -- the slot S of the last of wave volume coil 1433Y -- inserting in -- the -- jumping out -- 1438s of sections -- bending -- jumping out -- the point of 1438s of sections -- the last shape of U character of wave volume coil 1433Y -- it comes to weld to 1433d of points of a conductor 1433 As for half-pars-convoluta-lobuli-corticalis-renis 1438c, only the pitch of the half of the usual pars-convoluta-lobuli-corticalis-renis 1433c has extended in the hoop direction. the neutral point as used in the field of this invention -- the neutral point of U phase which makes a conductor -- a conductor -- only the required angle has extended in the hoop direction from the end of half-pars-convoluta-lobuli-corticalis-renis 1438c, section 1438z separating a predetermined gap to pars-convoluta-lobuli-corticalis-renis 1433c in the anti-stator-core 1410 side of pars-convoluta-lobuli-corticalis-renis 1433c

[0082] the shape of I character of V phase and W phase -- the neutral point of a conductor 1438 -- a conductor -- the shape of I character of U phase which also described section 1438z above, respectively -- the neutral point of a conductor 1438 -- a conductor -- it has the same structure as section 1438z however, the neutral point of each phase -- a conductor -- after it is installed in a hoop direction, section 1438z lapping in shaft orientations as shown in drawing 9 , 1438m of those points is welded and it becomes the neutral point

[0083] after all -- this example -- a drawer -- a conductor -- section 1436z and connection -- a conductor -- section 1437z and the neutral point -- a conductor -- still more suitable for \*\*\*\* side coil and Group B side, since section 1438z is approached and prepared in a \*\*\*\* side coil and the shaft-orientations outside of 1433c, it can jump out with a \*\*\*\* side coil and Group B, and can reduce the difference of a section side coil and shaft-orientations length with Group A -- it divides and comes out

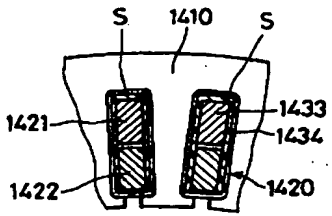
[0084] moreover, according to this example, as shown in drawing 8 , it installs in a hoop direction -- having -- these drawers of the coolant that mainly check the flow of shaft orientations -- a conductor -- section 1436z and connection - a conductor -- section 1437z and the neutral point -- a conductor -- since the rate of flow is not established near the large delivery 1680 (refer to drawing 2 ), section 1438z can reduce a flow resistance In addition, illustration of the layer insulation board 1670 is omitted in drawing 8 .

(Modification) a drawer -- a conductor -- the other examples of section 1436z are shown in drawing 9

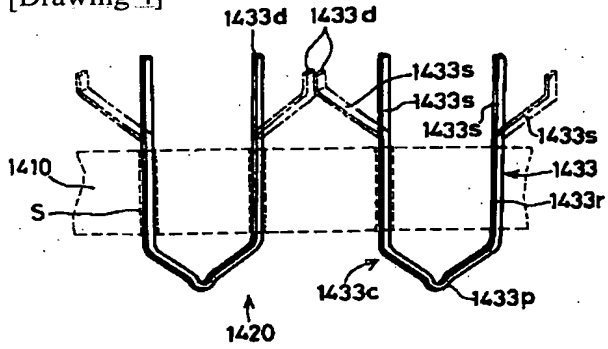
[0085] this example -- a drawer -- a conductor -- section 1436z is pulled out by shaft orientations and connected to the terminal which was fixed to the end-wall section of housing 1600 and which is not illustrated

(Modification) If the composition of a stator coil is a star polyphase coil, it can adopt various coil structures. For example,  $\pi / 6$  variation rates are carried out, 1 more set of group coil which consists of wave-winding coils 1433X and 1433Y mentioned above is formed in a hoop direction, carries out a series connection to it, and it is good also as a phase coil of a piece. In this case, the short paragraph connection section is formed.

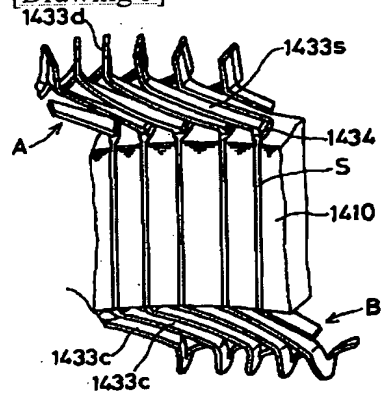




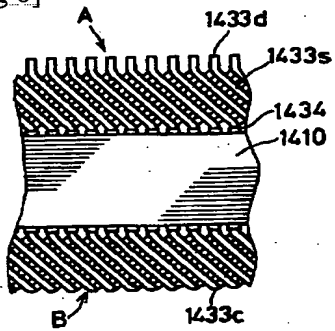
[Drawing 4]



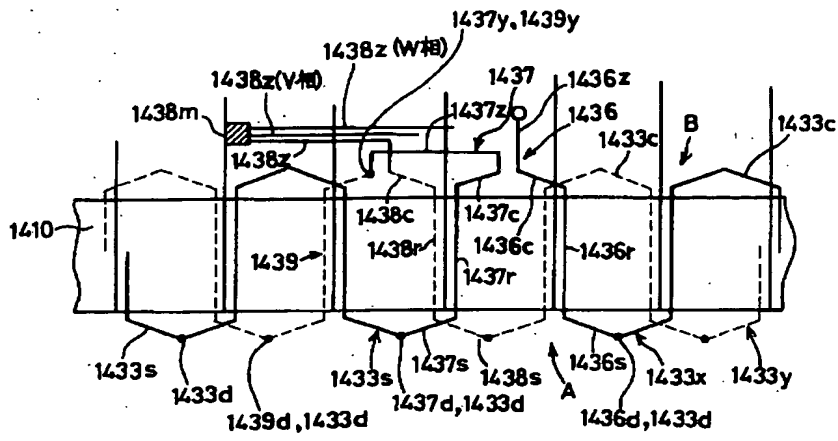
[Drawing 5]



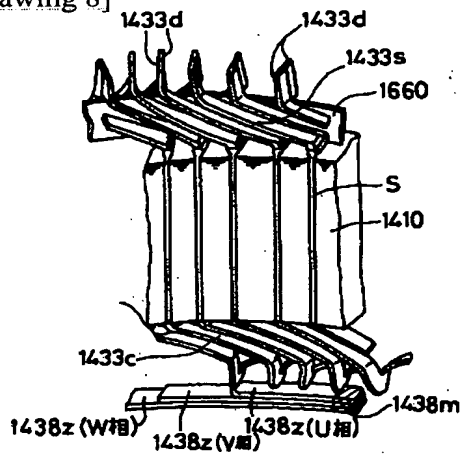
[Drawing 6]



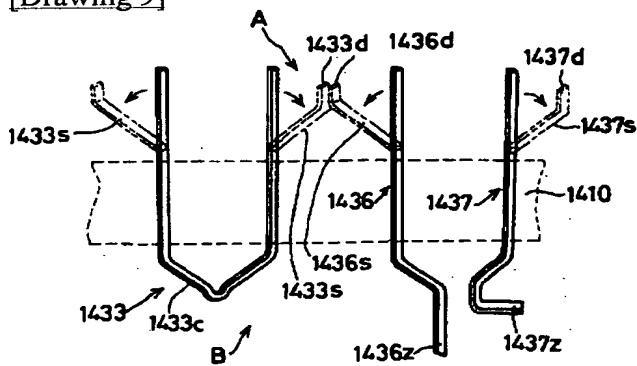
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]